THE
Tideſman's and Weigher's
NEW
POCKET COMPANION.

7.7.7b

531.d.32
2

Containing thoſe Rules of
ARITHMETIC,
Both *Vulgar* and *Decimal*,
That are Neceſſary for Tideſmen and
Weighers to underſtand
MEASURING
Of Bales, Caſes, and Wainſcot, after
the *Cuſtom-Houſe* Manner.

Alſo the whole Art of
CASK GAUGING.

By THOMAS WORLEY,
Teacher of the MATHEMATICS.

K

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47

TO THE

HONOURABLE

THE

COMMISSIONERS

OF HIS

MAJESTY'S CUSTOMS,

THIS

Small TRACT

IS

Humbly Dedicated and Preſented

By their HONOURS

moſt obedient Servant,

THOMAS WORLEY.

THE

PREFACE.

HAVING peruſed ſeveral Books concerning the Rules of Vulgar and Decimal Arithmetic, without finding any of 'em whoſe Rules are ſo perfectly demonſtrated, as to give any tolerable Satisfaction to a Learner, without the Help of a Maſter; I imagined, (as having practiſed and taught Mathematics for ſeveral Years, and thereby gained Experience and Knowledge,) that the digeſting my Thoughts into ſome ſuch Method, as might give a Learner full Satisfaction in thoſe Rules, that are uſeful to the Buſineſs of Tideſmen and Weighers, without being at the Charge of buying ſo many Books, might prove of ſome Service: And being

being importun'd thereto, by a great Number of Brother Tideſmen, I put thoſe Thoughts into Execution, and have at laſt brought them to the Perfection you here find the following Sheets, by which I hope my Brother Officers will reap Profit, which is the hearty Deſire of

THOMAS WORLEY.

NUMERATION

TEACHETH you to number: Number is a Mathematical Quantity compoſed of Units, a Unit ſignifies One, and is extended unto Nine, as the Tables demonſtrate.

TABLE,

C Millions	X Millions	Millions	C Thouſands	X Thouſands	Thouſands	Hundreds	Tens	Units
9	8	7	6	5	4	3	2	1
	8	7	6	5	4	3	2	1
		7	6	5	4	3	2	1
			6	5	4	3	2	1
				5	4	3	2	1
					4	3	2	1
						3	2	1
							2	1
								1

The Table is to be thus underſtood, begin with the Figure towards the

Right-Hand, and read them as they are wrote, *viz.* Units, Tens, Hundreds, Thouſands, Tens of Thouſands, Hundreds of Thouſands, Millions, Tens of Millions, Hundreds of Millions; then proceed to number them thus, nine Hundred, Eighty-ſeven Millions, ſix Hundred fifty four Thouſand, three Hundred, and Twenty-one: And ſo of the reſt, only obſerve that there is a Decreaſe of a Figure in every Line towards the Left-Hand.

ADDITION,

TEacheth you to add two or more Sums together, to make of them one whole or total Sum.

EXAMPLE.

l.
4737
1434
3601
467
10239

l.	*s.*	*d.*
435	17	11 ¼
164	16	07 ½
137	10	04 ¼
146	18	11 ¾
885	03	10 ¾

l.	*s.*	*d.*
3764	10	09 ¾
2374	14	10 ¼
3769	13	07 ½
1497	11	09 ¼
11406	11	00 ¾

Proceed as for the third Example, begin with the Farthings, and ſay one and two is three, and one is four, and three is ſeven Farthings, which is one Penny three Farthings, ſet down the three Farthings under the Place of Farthings, and carry one Penny to the Place of Pence, and ſay one Penny that I carry and 9 is 10, and 7 is 17, and 10 is 27, and 9 is 36 Pence, which is three Shillings, therefore ſet down a Cypher under the Place of Pence, and carry the three Shillings to the Place of Shillings, and begin with the Unit's Place of the Shillings, and ſay, three Shillings that I carry and 1 is 4, and 3 is 7, and 4 is 11, then come down to the Tens, and ſay 11 and 10 is 21, and 10 is 31, and 10 is 41, and 10 is 51 Shillings, which is two Pounds eleven Shillings, ſet down 11 Shillings under the Place of Shillings, and carry the two Pounds to the Place of Pounds, and ſay, 2 that I carry and 7 is 9, and 9 is 18, and 4 is 22, and 4 is 26, ſet down 6 under the firſt Column of the Pounds, and carry 2 to the ſecond Column, and ſay 2 and 9 is 11, and 6 is 17, and 7 is 24, and 6 is 30, ſet down a Cypher under the ſaid Column, and carry 3 to the third Column, and ſay, 3 that I carry and 4 is 7, and 7 is 14, and 3 is 17, and 7 is 24, ſet down the 4 under the ſame Column, and carry 2 to the fourth or laſt Column, and ſay 2 and 1 is 3, and 3 is 6, and 2 is 8, and 3 is 11, which ſet down, there being no more to be added up, and it makes 11406 *l.* 11 *s.* 00 *d.* $\frac{1}{4}$; and ſo of all other Sums, or Book Debts, which is very plain and demonſtrable by this Example.

CLOTH MEASURE.

Note,

FOUR Nails is one Quarter of a Yard, one Yard is four Quarters, one Ell *Engliſh* is five Quarters, and one Ell *Flemiſh* is three Quarters.

EXAM-

EXAMPLE.

Yds.	*qrs.*	*na.*	*Ells Eng.*	*qrs.*	*na.*
737	3	1	5764	3	2
163	1	0	1643	0	1
140	3	2	1432	1	0
38	2	1	476	4	1
1080	2	0	9316	4	0

Ells Flem.	*qrs.*	*na.*
543	1	0
130	0	3
169	2	1
304	1	0
1147	2	0

According to the former Examples in *Addition of Money*, ſo here, only obſerve how many of one Denomination makes one of another, that is, begin firſt with Nails, of which four makes one Quarter, ſo for every four Nails carry one to the Quarters, and for every four Quarters carry one to the Yards, then add the Yards as common Integers.

TROY

TROY WEIGHT.

Note,

24 Grains one Penny-weight, 20 Penny-weights one Ounce, 12 Ounces one Pound *Troy*.

£.	Oz.	Pwt.	Gs.
847	07	16	14
176	10	13	09
164	11	14	16
140	10	15	09
1330	05	00	00

£.	Oz.	Pwt.	Gs.
476	10	14	11
147	09	13	09
164	08	14	10
147	07	15	07
937	00	17	13

As before ſo here, for ſo many of one Denomination makes one of another; The Notes above are a plain Demonſtration.

Avoirdupoiſe

Avoirdupoiſe Weight.

Note,

16 Drams one Ounce, 16 Ounces one Pound, 28 Pounds one Quarter of a Hundred, 4 Quarters one hundred Weight, 20 Hundred Weight one Tun.

Tuns.	*Hun.*	*Qrs.*	*£.*	*Oz.*	*drs.*
4769	14	1	14	11	10
164	11	0	10	07	11
176	10	3	13	11	09
140	13	1	09	10	10
57	14	0	10	11	09
5309	03	3	03	05	01

Tuns.	*Hun.*	*Qrs.*	*£.*	*Oz.*	*drs.*
376	13	2	10	13	14
140	10	1	16	10	11
179	09	3	14	11	09
164	10	1	09	11	10
47	09	0	17	09	08
908	13	1	13	09	04

LIQUID MEASURE.

Note,

2 Pints is 1 Quart, 2 Quarts is 1 Pottle, 2 Pottles 1 Gallon, 63 Gallons 1 Hogſhead, 4 Hogſheads 1 Tun of Wine.

Tuns.	*Hds.*	*Gal.*	*Pot.*	*Qts.*	*Pts.*
476	3	24	1	0	1
369	1	17	0	1	0
196	0	14	1	0	1
48	2	16	0	1	0
17	1	14	1	1	0
1108	0	24	1	0	0

Tuns.	*Hds.*	*Gal.*	*Pot.*	*Qts.*	*Pts.*
578	2	17	1	1	1
147	1	11	0	0	1
106	0	16	1	1	0
174	1	14	0	0	1
169	0	10	1	1	0
1175	1	07	1	0	1

SUBSTRACTION.

Note,

TEacheth you to take a leſſer Number from a greater and to ſhew the Remainder.

Examples.

	l.	*s.*	*d.*
From	576	14	07 $\frac{3}{4}$
Take	345	13	03 $\frac{1}{4}$
Remains	231	01	04 $\frac{1}{2}$

	Yds.	*Qrs.*	*Na.*
From	476	2	3
Take	143	1	0
Remains	333	1	3

Bought

	£	Oz.	Pwt.	Gr.
Bought	47697	10	16	14
Sold at ſeveral Times	10433	07	11	07
	1763	11	09	10
	364	09	17	09
	437	04	06	10
Sold in all	12999	09	04	12
Remains unſold	34698	01	12	02
Proof	47697	10	16	14

	Tuns.	*Hun.*	*Qrs.*	*£.*	*Oz.*	*Drs.*
From	4769	17	2	10	07	14
Take	1643	14	1	14	13	10
	3126	03	0	23	10	04

	Tuns.	*Hds.*	*Gal.*	*Pot.*	*Qts.*	*Pt.*
Bought	4978	3	27	1	0	1
Sold	1434	1	19	0	1	0
Rem. unſold	3544	2	08	0	1	1

Theſe Examples are ſo very plain, that a Perſon of the meaneſt Capacity may underſtand them: However, for Information I ſhall here inſert the Method of working the firſt Example, and ſo the reſt may eaſily be underſtood.

Firſt I begin with the Farthings, and ſay, one Farthing I take from three Farthings and there remains two Farthings, which I ſet under the Place of Farthings; and proceed to the Pence, and ſay three Pence from ſeven Pence and there remains four Pence, which place under the Place of Pence; and proceed to the Shillings, and ſay, thirteen Shillings from fourteen Shillings and there remains one Shilling, which place under the Place of Shillings; and then proceed to the Pounds, and ſay 5 from 6 and there remains 1, which place under the 5, then 4 from 7 and there remains 3, then laſtly, 3 from 5 and there remains 2, ſo the whole Remainder is 231 *l.* 01 *s.* 04 *d.* ½.

The third Example as follows, the Sum above the Line is the Quantity of

Pounds, Ounces, Penny-weights and Grains, that was firſt bought, and the ſeveral Sums below the Line are the Quantities ſold, which being added together, and placed in the firſt Line, is the whole Sum diſpoſed of, which Sum being ſubſtracted from the Sum firſt bought, produceth the ſecond Line; the ſaid ſecond Line being added to the firſt, gives the third Line, or Proof. And ſo of all other Examples.

MULTIPLICATION,

Is compoſed of three certain Branches, *Viz.*

1*ſt.* The Multiplicand, or Sum given to be multiplied.

2*d.* The Multiplier, or Sum given to multiply with.

3*d.* The Product, or total Sum produced.

TABLE.

1	2	3	4	5	6	7	8	9	10	11	12
2	4	6	8	10	12	14	16	18	20	22	24
3		9	12	15	18	21	24	27	30	33	36
4			16	20	24	28	32	36	40	44	48
5				25	30	35	40	45	50	55	60
6					36	42	48	54	60	66	72
7						49	56	63	70	77	84
8							64	72	80	88	96
9								81	90	99	108
10									100	110	120
11										121	132
12											144

An Explanation of the preceding Table, to underſtand which you muſt begin with the firſt Column towards the Left-Hand, which is number'd from 1 to 12, and ſay, twice 2 is 4, which you'll find in the Angle of meeting, and twice 3 is 6, and twice 4 is 8, and ſo thro' all the Line till you end in the Product 24; then proceed to the next Figure in the ſaid Column, which is 3, and ſay three times 3 is 9, which is in the Angle of meeting, and three times 4 is 12, and three times 5 is 15, and ſo on till you end the ſaid Line in 36; and then to the next Figure which is 4, and ſo with every Figure in the Column, till you have ended the Table with 12 times 12 is 144; which muſt be got very perfect, ſo that you ſay it without Book, which will be of infinite Uſe in the following Rules.

Let it be required to multiply 4769 *l.* by 43 *l.*

```
 4769 Multiplicand
   43 Multiplier
 -----
 14307
19076
------
£205067 Product.
```

Let it be required to multiply 34694 *l.* by 354 *l.*

```
    34694
      354
   ------
   138776
  173470
 104082
 --------
£ 12281676 Product
```

To work the firſt Example, *viz.* 4769 by 43, place them as in the Example, the Multiplier under the Multiplicand, and proceed thus, Multiply the firſt Figure of the Multiplier into the firſt Figure of the Multiplicand, that is 3 times 9 is 27, ſet down the 7 under the Line, and directly under the Multiplier 3, carry the 2, then 3 times 6 is 18, and 2 that I carry is 20, ſet down the Cypher, and carry the 2 to the next Figure, and ſay 3 times 7 is 21, and 2 that I carry is 23, ſet down the 3 and carry 2, then 3 times 4 is 12, and 2 that I carry is 14, this being the laſt Figure or Product of the Multiplicand by the firſt Figure of the Multiplier, therefore I ſet the whole 14 down, which makes the firſt Line under the Line of Separation; and begin with the next Figure of the Multiplier, which is 4, and ſay 4 times 9 is 36, ſet down the 6 and carry 3, then 4 times 6 is 24, and 3 that I carry is 27, ſet down the 7 and carry 2, then 4 times 7 is 28, and 2 that I carry is 30, ſet down the Cypher and carry 3, then 4 times 4 is 16, and 3 that I carry is 19, which 19 I ſet down, there being no more Figures in either Multiplicand or Multiplier; therefore I add the two Lines together, which makes the Product 205067*l.* And ſo of all other Examples of this common way; but I ſhall now ſhew the Method of multiplying by Parts, which is very uſeful.

Multiplication of Parts.

YOU are to find out two Numbers by your *Multiplication* Table, which being multiplied together ſhall produce the Quantity given, which is clearly demonſtrated by the following Example:

What comes 15 £. of Tea to, at 6 *s.* 8 *d. per* Pound?

	s.	*d.*	
	6	8	
		5	*Greateſt Factor.*
1	13	4	
		3	*Leſſer Factor.*
£ 5	00	0	*Total.*

N. B. Here the Quantity given is 15*£*. and the two Factors is 5 and 3, which being multiplied together produce the Quantity given.

Therefore take out your Price, which is 6 *s.* 8 *d.* and multiply by your greateſt Factor, and that Product by the leſſer Factor produceth the true Value or Sum of 15*£*. of Tea, as *per* Example.

So the true Value of any Quantity of Goods may be found.

What comes 45 Yards of Cambrick to, at 9 *s.* 6 *d.* *per* Yard?

	s.	*d.*	
	9	6	
		9	*Greater Factor*
£ 4	5	6	
		5	*Leſſer Factor.*
£ 21	07	6	*true Content.*

What comes 100 Gallons of Wine to, at 7*s.* 6 *d.* *per* Gallon?

	s.	*d.*	
	7	6	
		10	
£ 3	15	0	
		10	
£ 37	10	0	*Total.*

What comes 200 Ounces to, at

l.	*s,*	*d.*	
3	17	6	*per Ounce.*
		10	
£ 38	15	0	
		10	
£ 387	10	0	*Product of* 100
		2	
£ 775	00	0	*true Content.*

DIVI-

DIVISION,

IS compoſed of three certain Branches, and one uncertain Branch:

Viz.

1*ſt*. The Dividend, or Sum given to be divided.

2*d*. The Diviſor, or Sum given to divide with.

3*d*. The Quotient, or Number of equal Parts the Dividend is divided into.

4*th*. The Remainder, after the Work is ended, this is called an uncertain Branch, becauſe ſometimes there happen Remainders and ſometimes none.

N. B. The Remainder muſt always be leſs than the Diviſor.

Let it be required to divide 74598 by 43.

Dividend *Quotient*
Diviſor 43) 74598 | 1734
43
315
301
149
129
208
172
(36)

To perform this Example, and all others in this Rule, ſeek how often the firſt Figure of the Diviſor may be had in the Dividend, that is, how many times 4 may be had in 7, which is 1, which 1 place in the Quotient, and multiply it into the Diviſor, *viz.* once 3 is 3, which place under the 4 in the Dividend, then ſay once 4 is 4, and place it under the 7, then draw a Line of Separation, and ſubſtract it from the Dividend, and to the Remainder bring down the next Figure of the Dividend, putting a Prick over the Top of it to prevent Miſtakes, and call this 315 a new Dividend; then proceed to ſeek how often the Diviſor may be had in the new Dividend, which I find to be 7, which put in the Quotient, and multiply the ſaid 7 into the Diviſor, and ſet the Product under the new Dividend aforemention'd, and ſubſtract it therefrom, and to the Remainder bring down the next Figure in the Dividend, and proceed in all reſpects as before, till all the Figures are brought down, and then the Work is ended.

To prove this Example, multiply your Quotient by the Diviſor, and take in the Remainder, and if the Work is right, the Product will be the ſame as the Dividend.

Obſerve the following Examples.

Let it be required to divide 4768376 by 863.

```
Example. 863 ) 4768376 | 5525
               4315
               -----
                4533
                4315
                -----
                 2187
                 1726
                 -----
                  4616
                  4315
                  -----
                   301
```

This Example may be perform'd in one Line, by ſetting the Quotient under the Dividend.

```
Quotient         863 ) 4768376 |
                      ---------
  5525                 5525 301/863
   863 Diviſor        ---------
 -------
  16576
 33150
44203
-------
4768376 Proof
-------
```

When you are well acquainted with the Manner of working the former, theſe you'll find to be very plain and eaſy.

REDUCTION,

Either of *Money*, *Weight*, or *Meaſure*,
Is compoſed of two certain Branches,
Viz.

1*ſt*. All great Names are brought into ſmall by Multiplication.

2*d*. And all Small into Great by Diviſion.

EXAMPLE.

In 476*l*. 17*s*. 9*d*. how many Shillings, Pence and Farthings?

l.	*s.*	*d.*
476	17	9
20		
9537 *Shillings.*		
12		
114453 *Pence.*		
4		
457812 *Farthings.*		

In 457812 Farthings how many Pence, Shillings and Pounds?

```
   4) 457812
      ------
  12) 114453 | 9
      ------
 2|0) 953    | 7
      ----
   £ 476  17  9
```

In 8769 Ells Engliſh, 3 Quarters 1 Nail, how many Quarters and Nails?

```
Ells Eng. Qrs. Nls.
  8769     3    1
     5
---------------
 43848 Qrs           4) 175393
     4                  ------
---------------      5) 43848
175393 Nails            -----  Qrs. Nls.
---------------      Ells 8769   3    1
```

In 3647 *£*. 10 *Oz.* 24 *Pwt.* 17 *Grs.* how many Ounces, Penny-weights, and Grains.

£.	*Oz.*	*Pwt.*	*Grs.*
3647.	10.	14	17

12

43774 *Ounces*
20

875494 *Penny-weights*
24

3501983
1750989

21011873 *Grains*

TARE

TARE and TRET.

GROSS is the Weight of a Commodity with the Caſk, Hogſhead; Box, Bag, Bale, or whatever contains it.

Tare is the Weight of the Caſk, Hogſhead, Box, Bag, or Bale only.

Tret is an Allowance of four Pounds *per* Hundred for Waſte, and Duſt on ſome ſort of Goods; but this the Merchant only allows to the Retailer, tho' he himſelf is allowed no more than Tare in paying Cuſtom.

EXAMPLE.

In 5 Hogſheads of Tobacco, each 9*C.* 1 *Qr.* 17 *£.* Groſs, Tare 23 *£.* *per* Hogſhead, how many *C.* neat?

	C.	*Qr.*	*£.*	
	9	1	17	*Groſs*
			5	*Number*
	47	0	1	*Groſs in all*
	1	0	3	*Tare*
C	45	3	26	*Neat Weight.*

The Queſtion here is 5 Hogſheads, each containing 9 *C.* 1 *Qr.* 17 *£.* Groſs Weight, which multiply'd by 5, the Number of Hogſheads, produceth the Groſs Weight in all; then 23 *£.* multiplied by 5, gives the Tare in all, which Tare Weight, ſubſtracted from the Groſs leaves the neat Weight 45 *C.* 3 *Qr.* 26 *£.* and ſo of the following Examples.

In 100 Hogſheads of Sugar, each 13 *C.* ½ *Qr.* 14 *£.* Groſs, Tare 48 *£.* *per* Hogſhead, how many hundred neat?

	C.	*Qr.*	*£.*	
	13	½	14	
			10	
	136	¼	0	
			10	
C	1362	½	0	*Groſs in all.*
C	42	¾	12	*Tare in all.*
C	1319	½	16	*Neat Weight.*

In 400 Caſks of Cocoa, each 4 *C.* ¼ *Qrs.* 9 *£.* Groſs, Tare 14 *£.* *per* Caſk, how many hundred neat?

	C.	*Qrs.*	*£.*	
	4	¼	09	
			10	
C	48	¼	06	
			10	
C	483	0	4	*Groſs Weight in one C.*
			4	
C	1932	0	16	*Groſs Weight in all.*
	50	0	0	*Tare in all*
C	1882	0	16	*Neat Weight.*

In 900 Cheſts of Tea, each 3 *C.* ½ *Q.* 11 *£.* Groſs, Tare 17 *£.* *per* Cheſt, how many hundred neat?

	C.	*Qrs.*	*£.*	
	3	½	11	
			10	
	35	¾	26	
			10	
	359	¼	16	*Groſs in one hundred.*
			9	*Number of Cheſts.*
C	3238	¼	16	*Groſs in all.*
	136	½	12	*Tare in all.*
C	3101	¾	04	*Neat Weight.*

Theſe Examples are ſufficient for this Rule; the Allowance for Tret is 4 Pounds *per* Hundred, which the Merchant allows the Retailer, and no way concerns the King or Cuſtoms, therefore I think it needleſs to treat upon it here.

The

THE

RULE of THREE Direct.

IN this Rule obſerve to bring your firſt and third Number both into one Name; that done, reduce your ſecond Number into the loweſt Name in Uſe, then multiply your ſecond and third Number one by the other, and divide the Product thereof by the firſt Number, and the Quotient of the Diviſion is the Anſwer to the Queſtion, in the ſame Name you left your ſecond Number in.

This Note is a plain Demonſtration of the working of all the following Examples.

EXAMPLE.

If one Pound coſt 4*d.* $\frac{1}{4}$, what coſt 147 Pounds?

£. — *d.* — £.
1 —— $4\frac{1}{4}$ —— 147
4 — 17

17 — 1029
147

4 | 2499
12 | $624\frac{3}{4}$
2|0 | 5|2
£ 2 12 $0\frac{3}{4}$

If $5\frac{1}{5}$ Ells of Cambrick coſt 21*s.* 8*d.* what coſt 120 Pieces? *viz.*

	Ps.	*Ells.*	*Qrs.*	*Na.*
A	—30—qt	272	2	1
B	—50—qt	401	3	1
C	—40—qt	341	1	3
	Ells	1015	2	1

Then

Ells. *s.* *d.* *Ells.* *Qr.* *Na.*

If $5\frac{1}{5}$—21 8—1015 2 1

5 12 5

26 260 5077

4 4 *Qrs.*

104 20309 *Nails*

260

1218540

40618

104) 5280340

12) 50772

2|0) 423|1

£ 211 11 *Total.*

So 1015 *Ells* 2 *qrs.* 1 *na.* coſt 211 *l.* 11 *s.*

Some Queſtions for Practice.

If I buy a Piece of Cloth for 84*l.* 11*s.* and I ſell the Ell *Engliſh* for 7*s.* 8*d.* I demand how many Yards were contained in the ſaid Piece?

	Yds.	*Qrs.*	
Anſwer	275	2	$\frac{16}{92}$

Sold four Parcels of Sugar containing as followeth, how many hundred neat, and what comes to, at 1*l.* 15*s. per* Hundred neat?

	C.	*Qrs.*	*£.*		*£.*
N° 1—*A*—qt—	86	$\frac{1}{2}$	21		84
2—*B*—qt—	76	$\frac{1}{4}$	12	*Tare*	56
3—*C*—qt—	98	$\frac{1}{4}$	11		92
4—*D*—qt—	75	$\frac{1}{4}$	17		83
	337	$\frac{1}{4}$	05	*Tare*	315

337	$\frac{1}{4}$	05	*Groſs Weight*
2	$\frac{3}{4}$	07	*Tare*
334	$\frac{1}{4}$	26	*Neat Weight.*

	£.	*l.*	*s.*	*C.*	*Qrs.*	*£.*
Then if	112	1	15—	334	$\frac{1}{4}$	26
Anſwer £.	585	6		10	$\frac{1}{2}$	

PRAC-

PRACTICE.

THIS Rule well deſerves its Name, it being the ſhorteſt and readieſt Method for practical Buſineſs.

And firſt of the Tables

The even Parts of a Pound Sterling.			The even Parts of a Shilling.			The even Parts of one hundred Weight.		
10	is the	$\frac{1}{2}$	6	is the	$\frac{1}{2}$	*Pd. wt.*		*Cont.*
6*s.* 8*d.*	is	$\frac{1}{3}$	4	is	$\frac{1}{3}$	56	is the	$\frac{1}{2}$
5	is	$\frac{1}{4}$	3	is	$\frac{1}{4}$	84	is	$\frac{3}{4}$
4	is	$\frac{1}{5}$	2	is	$\frac{1}{6}$	28	is	$\frac{1}{4}$
3*s.* 4*d.*	is	$\frac{1}{6}$	1 $\frac{1}{2}$	is	$\frac{1}{8}$	14	is	$\frac{1}{8}$
2*s.* 6*d.*	is	$\frac{1}{8}$	1	is	$\frac{1}{12}$	16	is	$\frac{1}{7}$
2	is	$\frac{1}{10}$				8	is	$\frac{1}{14}$
1	is	$\frac{1}{20}$				7	is	$\frac{1}{16}$

There is no Difficulty in the underſtanding the Tables, for the firſt Column ſhews you the Quantity of Shillings, Pence, *&c.* that is equal to that

Part of a Pound or Shilling that is oppoſite, *viz.* 10*s.* is the half of a Pound Sterling; and 6*d.* is the half of a Shilling; and 56 is the half of an Hundred Weight; and ſo of any other Sum from the Top to the Bottom of the ſaid Tables.

EXAMPLE.

476 Pound Weight at 10 *s.* *per* Pound.

To perform this, take out the Quantity, and find that Part of a Pound Sterling that is equal to the Price given, which I find by the Table, 10 *s.* is the half of a Pound Sterling; therefore ſtate your Queſtions as *per* this Example, *viz.*

s.		£.
10	½	476
		£. 238 *Anſwer.*

476 £. at 6 *s.* 8 *d.* *per* Pound.

s. *d.*		£.
6 8	⅓	476
		£ 158 13 4 *Anſwer.*

3747 £. at 6 *d.* *per* Pound.

As before, in finding the Part of a Pound Sterling, ſo in this Example for the Parts of a Shilling.

| *d.* | | £. |
| 6 | $\frac{1}{2}$ | 3747 |

2|0|187|3 : 6

£. 93 : 13 : 6 *Anſwer.*

5374 *C.* $\frac{3}{4}$ *Qrs.* at 16 *s.* 7 *d.* *per* Hundred.

s.		*C.*	*Qrs.*
5	$\frac{1}{4}$	5374	$\frac{3}{4}$
2	$\frac{1}{10}$	16	
		32244	
		5374	
		85984	
		1343	10
		537	8
		12	5 3
		87877	3 3 *Anſwer.*

To find the Value of the $\frac{3}{4}$

C.		*l.*	*s.*	
56	$\frac{1}{2}$	16	7	
28	$\frac{1}{2}$			
		8	3	6
		4	1	9
		£ 12	5	3

Theſe Examples well underſtood, which are very plain, are ſufficient for this Rule.

Decimal

Decimal Arithmetic,

NOTATION.

A Decimal Fraction is an artificial Way of ſetting down and expreſſing of natural and vulgar Fractions, as whole Numbers; and whereof the Denominators of Vulgar Fractions are divers; the Denominators of Decimal Fractions are always certain; for as a Decimal Fraction hath always for its Denominator an Unit, with a Cypher or Cyphers annexed to it, therefore in writing down a Decimal Fraction there is no Neceſſity of writing down the Denominator, for by bare Inſpection it is certainly known, *viz.*

Numerator	5	25	051
Denominator	10	100	1000

ADDI-

ADDITION,

IS performed the ſame Way as *Addition* of whole Numbers, you only muſt obſerve to place your Numbers right, that is, Units under Units, Primes under Primes, Seconds under Seconds, *&c.*

EXAMPLES.

476,374	568,436
47,33	46,937
4,1	1706
527,804	5432736

SUBSTRACTION.

IS performed likewiſe as in whole Numbers, reſpect being had to the right placing the Numbers, as in the following Examples.

From	212,0137	*From*	201,1250
Take	31,1275	*Take*	5,5785
Rem.	180,8862	*Rem.*	195,5465

MUL-

MULTIPLICATION,

IS alſo performed the ſame Way as of whole Numbers, but to know the Value of the Product obſerve the Rule; cut off, or ſeparate by a Comma, or Prick, ſo many Decimal Places in the Product as there are Decimals in both Factors, *viz.* in the Multiplicand and Multiplier.

```
    6,75        476,3        ,75
     ,25         4,67        0,5
  ------     --------     ------
    3375        33341      ,0375
   1350        28578      ------
  ------      19052
  1,6875     --------
             2224,321
```

DIVISION.

IS performed after the ſame Manner as in whole Numbers, but to know the Value or Denomination of the Quotient is the only Difficulty, to reſolve which, obſerve the following Rules.

When the Work of Diviſion is ended, count how many Places of Decimal Parts there are in the Dividend more than in the Diviſor, that Exceſs is the Number of Places which muſt be ſeparated in the Quotient for Decimals; but if there be not ſo many Figures in the Quotient as is the ſaid Exceſs, that Deficiency muſt be ſupply'd with Cyphers in the Quotient prefixt before the ſignificant Figures thereof, towards the

Left-Hand, with a Point or Comma before them, ſo ſhall you plainly diſcover the Value of the Quotient.

```
43,2)739,0645 | 17,107     4.976)59,43476 | 11,94
     ————————                    ————————
      3070                        9674
     ——————                      ——————
       466                        46987
     ———————                     ————————
        3445                        22036
       ————————                    ————————
         421                         2132
```

Multiplication of Feet and Inches.

Obſerve the following Directions.

1*ſt.* Feet multiplied by Inches produce Feet and Inches.

2*d.* Inches multiplied by Inches produceth Inches and Parts.

3*d.* Inches by Parts produceth firſt Parts and Seconds.

4*th.* Parts by Parts produceth Second Parts and Thirds.

5*th.* Parts by Feet produceth Inches and Parts.

General Examples.

Let it be required to multiply 42 Feet 7 Inches by 36 Feet 11 Inches.

Feet.	*Inches.*		
42	7		
36	11		
252			
126	*In.*	*Pts.*	
21	0	0	is 36 multiplied by 7.
38	6	0	is 42 multiplied by 11.
	6	5	is 7 multiplied by 11.
Ft. 1572	0	5	

To work the foregoing Example, I first multiply 36 into 42, which produces 252 and 126; then multiply 36 Feet into 7 Inches, and that will produce 252 Inches, which divided by 12 gives 21 Feet; then 42 Feet by 11 Inches, and that produces 462 Inches, which divided by 12 gives 38 Feet 6 Inches; then 11 Inches by 7 Inches, and that produces 77 Parts, which divided by 12 gives 6 Inches and 5 Parts, as you may plainly ſee by the Work; then draw a Line of Separation, and add them up, and you'll find the Product to contain 1572 ſquare Feet and Parts. And ſo of the reſt.

Another Example.

Let it be required to multiply 8 Feet 4 Inches 6 Parts by 6 Feet 9 Inches 9 Parts.

	Ft.	*In.*	*Pts.*		
	8	4	6		
	6	9	9		
		6	3	4	6
	6	3	4	6	
	50	3	0		
Feet	57	0	7	10	6

How

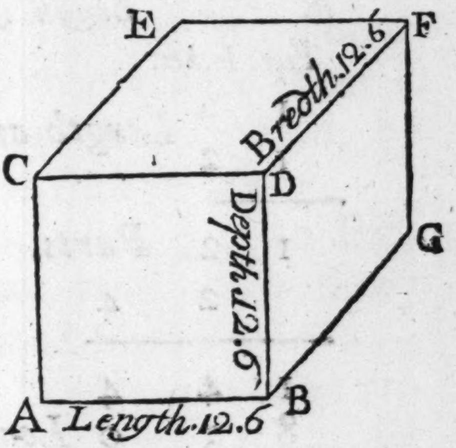
How to take the Dimenſions of Bales, Caſes, and Boxes, and to find the ſolid Content,

To meaſure a ſquare Bale, whoſe Dimenſions are as *per* Figure.

Rule.

Multiply the Length by the Breadth, and that Product by the Depth gives the ſolid Content.

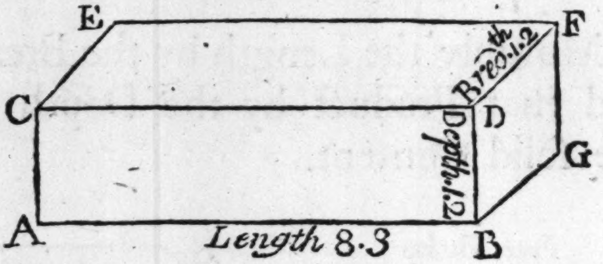
Feet.	*Inches*		
12	6		*Length*
12	6		*Breadth*
150	2		
6	0		
0	3		
156	3		
12	6		*Depth*
1875	0		
78	0		
0	1	6	
Feet 1953	1	6	*True Content.*



To Meaſure a Caſe in Form of a Parallel Opipedon, or ſquare Priſm.

Rule.

Multiply the Length by the Breadth, and that Product by the Depth, and the laſt Product is the ſolid Content.



	Feet.	*Inches.*		
	1	2		*Length and Breadth.*
	1	2		
	1	2	*Parts.*	
		2	4	
	1	4	4	
	8	3	0	*Length.*
	0	4	1	
	10	10	8	
Feet	11	2	9	*True Content.*

To

To meaſure Wainſcot after the Cuſtom-Houſe *Method.*

Take Notice that a Board of 12 Foot long and 1 Inch thick, is called an Inch of Wainſcot, the Breadth is generally about a Foot, but more or leſs it's not regarded.

If the Thickneſs be more or leſs than an Inch, reduce them to an Inch, as if 100 Boards of $\frac{1}{4}$ of an Inch thick, being laid one upon another, is no more than 25 Inches, then reduce them if the Length be leſs than 12 Foot, by ſuppoſing them ſet End by End.

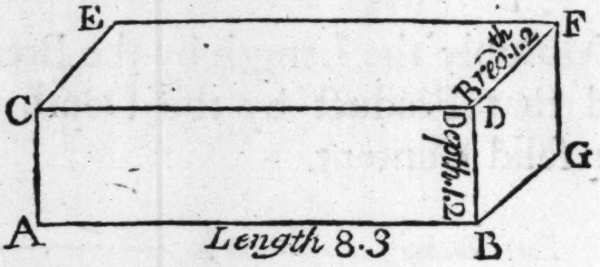
Suppoſe 100 Boards of $\frac{1}{4}$ of an Inch thick, and 6 Foot long, how many Inches are contained therein?

Now the 100 Boards, one upon another, will be but 25 Inches thick, for 4 Boards is but 1 Inch thick, and 4 more at the End of them is but 1 Inch of Wainſcot; therefore 8 Boards of $\frac{1}{4}$ thick and 6 Foot long, goeth to 1 Inch.

To Meaſure a Caſe in Form of a Parallel Opipedon, or ſquare Priſm.

Rule.

Multiply the Length by the Breadth, and that Product by the Depth, and the laſt Product is the ſolid Content.



	Feet.	*Inches.*		
	1	2		*Length and Breadth.*
	1	2		
	1	2	*Parts.*	
		2	4	
	1	4	4	
	8	3	0	*Length.*
	0	4	1	
	10	10	8	
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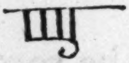
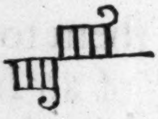
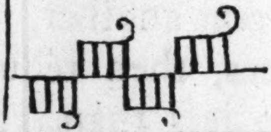
Obſerve the following Method for keeping a Book, and entering therein Wainſcot Plank.

Quantity of Boards.	Thickneſs in Inches.	The Method of tallying Planks with the Length.	Quantity of Inches to pay Duty.
		12 Feet Long.	
50	1		50
100	$\frac{3}{4}$		75
200	2 $\frac{1}{2}$		500
		9 Feet Long.	
100	2		150
150	$\frac{1}{2}$		56 $\frac{1}{4}$
		6 Feet Long.	
250	1 $\frac{1}{4}$		156 $\frac{1}{4}$
90	$\frac{1}{4}$		11 $\frac{1}{4}$

Note, There is ſeldom any other Lengths than 12 Foot, 9 Foot, and 6 Foot, and the Thickneſs is taken about the Middle of the Board's End.

Now to work ſome of the Examples here enter'd, which are all the Varieties that can happen:

How many Inches of Wainſcot are there in 100 Boards at 12 Foot long, and $\frac{3}{4}$ of an Inch thick?

	Boards.	*Qrs.*	*Boards.*	
If	1	3	100	
			3	
			4|300	
			Inches 75	*Anſwer.*

How many Inches of Wainſcot are there in 200 Boards of 12 Foot long, and 2 $\frac{1}{2}$ Inches thick?

	Boards.	*Qrs.*	*Boards.*
If	1	10	200
			10
			4|2000

Inches 500 *Anſwer.*

How many Inches of Wainſcot are there in 100 Boards of 9 Foot long, and 2 Inches thick?

	Boards.	*Inch.*	*Boards.*
If	2	3	100
			3
			2|300

Inches 150 *Anſwer.*

How many Inches of Wainſcot are there in 150 Boards of 9 Foot long, and $\frac{1}{2}$ an Inch thick?

N. B. Here 4 Boards contain 1 Inch and $\frac{1}{2}$, or 6 Quarters.

Boards. Qrs. Boards.
Then if 4 6 150
6
4|900
4|225
Anſwer in Inches 56 $\frac{1}{4}$

How many Inches of Wainſcot are contained in 250 Boards of 6 Foot long, and 1 Inch and $\frac{1}{4}$ thick?

Boards. Qrs. Boards.
If 2 5 254
5
2|1250
4|625
Anſwer in Inches 156 $\frac{1}{4}$

How many Inches of Wainſcot are there in 90 Boards of 6 Foot long, and $\frac{1}{4}$ of an Inch thick?

Boards. *Qrs.* *Boards.*
If 8 4 90
4

8|360

4|45

Anſwer in Inches 11 $\frac{1}{4}$

CASK GAUGING.

BEFORE we can find the Contents of a Caſk we muſt know the Dimenſions of it, *viz.*

$$\text{The}\left\{\begin{array}{l}\text{Bung}\\ \text{Head}\\ \text{Length}\end{array}\right\}\text{Diameters}\left\{\text{in Inches.}\right.$$

And when theſe are known, the Form or Shape of the Caſk muſt be conſider'd, for altho' the Diameters, and the Length of one Caſk may be equal to thoſe of another, yet one of theſe Caſks may contain ſeveral Gallons more than the other, and therefore the Contents of all Caſks cannot be found by one and the ſame Rule.

The Varieties are as follow:

1*ſt*. The middle Fruſtrum of a Spheriod.
2*d*. The middle Fruſtrum of a parabolical Spindle.
3*d*. The middle Fruſtrum of two parabolical Conoids abutting upon one common Baſe.
4*th*. The middle Fruſtrum of two Cones abutting upon one common Baſe.

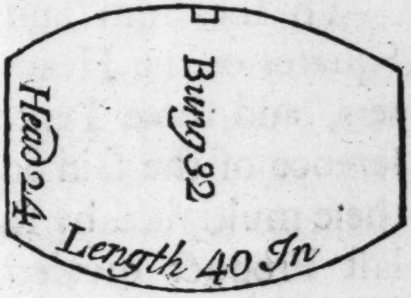
PROB. I.

There is a Caſk, ſuppoſed to be the middle Fruſtrum of a Spheriod, intercepted between two Plains parallel, cutting the Axis at right Angles; let the Diameter at the Bung be 32 Inches, the Diameter at Head 24 Inches, and the Length 40 Inches: How many Ale or Wine Gallons will this Caſk contain?

Rule.

To the Sum and half Sum of the Square of the Bung and Head Diameters, and half the Difference of the ſaid Square, the Sums of theſe multiplied by the Length, and this Product divided by

1077 } Quotes { Ale } Gallons.
882 } { Wine }



32 *Bung Diam.*
32

64
96

1024 *Square of Bung*

24 *Head Diam.*
24

96
48

576 *Square of Head*

1024 *Sq. of Bg* } *Diam.*
576 *Sq. of Hd* }

1600 *Sum of the Squares*
800 *half Sum*
224 *half Difference*

2624
40 *Length*

882) 104960

119 : 2 *Wine Gallons.*

Prob. II.

Suppoſe a Caſk of the ſame Diameters and Length with the former, ſhall have its Staves betwixt the Bung and Head leſs curved, ſo as to leave out about a third Part of the Curvature of the former, how many Ale or Wine Gallons will this Caſk contain?

Rule.

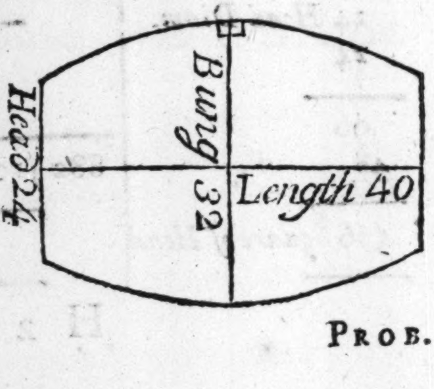
To the Sum and half Sum of the Squares of the Head and Bung Diameters, add three Tenth Parts of the Difference of the ſaid Squares, the Sum of theſe multiplied by the Length, and the laſt Product divided by the common Diviſor, gives the Content in Ale or Wine Gallons reſpectively.

1024 *Square of the Bung* } Diameters
576 *Square of the Head* }
134,4 $\frac{3}{10}$ *of the Difference*
800 *half Sum*

25344
40 *Length*

882) 101376,000

114,938 *Wine Gal.*



Prob.

PROB. III.

There is a Caſk whoſe Staves between the Bung and Head have but little Curvature to the former Examples, what is the Content in Ale or Wine Gallons?

Rule.

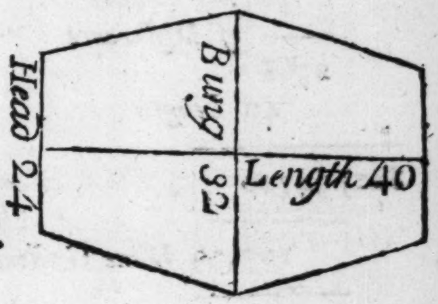
To the Sum and half Sum of the Squares of the Bung and Head Diameters, add one Tenth of the Difference of the Squares, the Sum of theſe multiplied by the Length, and this Product divided by the common Diviſor, quotes the Content in Ale or Wine Gallons.

1024 *Square of the Bung* } *Diameters*
576 *Square of the Head* }
800 *half Sum*
64 $\frac{1}{10}$ *of the Difference*

2464
40 *Length*

882) 98560 |

111 : 71 *Wine Gal.*



Prob. IV.

To find the Content of a Caſk in Form of the middle Fruſtrum of two Cones abutting upon one common Baſe, iſ any ſuch can be made.

Rule.

From the Sum and half Sum of the Squares of the Bung and Head Diameters, ſubſtract half the Square of the Difference of the Diameters themſelves; multiply the Remainder by the Length, and divide the laſt Product by the common Diviſor, and the Quotient will be the Content in Ale or Wine Gallons.

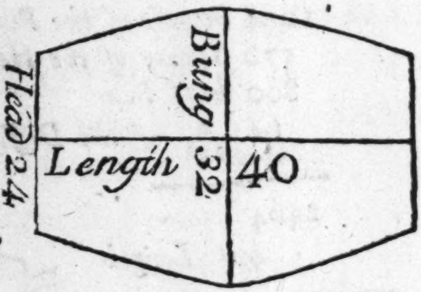
1024 *Sq. of the Bg.*
576 *Sq. of the Hd.*
800 *half Sum*

2400
32 *half Square of Difference*

2368
40 *Length*

882) 94720

107,39 *Wine Gallons.*



To Ulage a Caſk laying.

To the whet or dry Inches add a competent Number of Cyphers, ſuppoſe 4, that Product divided by the Bung Diameter, if the Quotient exceed 5000, add to the Quotient $\frac{1}{4}$ of the Exceſs, and multiply this Sum by the whole Content gives the Ulage.

But if the Quotient be leſs than 5000, take from the Quotient $\frac{1}{4}$ of what it wants, and the Remainder multiply into the Content gives the Ulage.

Theſe Rules are for a Cylinder, or near that Form, but if the Bung be much greater than the Head, then inſtead of $\frac{1}{4}$, add or ſubſtract $\frac{1}{3}$, and multiply as before.

EXAMPLE.

There is a Caſk whoſe whole Content, when full, contains 6,096 Gallons, the wet Inches 21, the Bung Diameter 28 Inches, what is the Content of the Ulage?

Wet Inches.
Bung 28)21,0000(,7500
625$\frac{1}{4}$ *of the Exceſs added*
,8125 *Sum*
60,96 *whole Content.*
48150
73125
487500
49,529400 *Content of the Ulage is* 49,53 *Gal.*

To Ulage a Caſk ſtanding, by the Pen.

To the wet or dry Inches, add a competent Number of Cyphers as before, and divide by the Length, if the Quotient exceeds 5000, add to the Quotient $\frac{1}{10}$ of the Exceſs, but if leſs ſubſtract $\frac{1}{10}$ of the Exceſs from the Quotient, ſo will the Sum be a Decimal, which multiplied by the whole Content gives the Content of the Ulage.

EXAM-

EXAMPLE.

Suppoſe a Caſk whoſe Length is 32 Inches, the wet Inches 18, and the whole Content when full is 60,96 Gallons, what is the Content of the Ulage?

Wet Inches.
Length 32) 18,0000 | ,5625
,625

,56875
60,96

341250
511875
3412500

Gallons of Liquor 34,6710000 *in the Caſk.*

F I N I S.

ERRATA.

PAGE 32, line 10, read 8 inſtead of 16. p. 40, l. 2, read *Notation* inſtead of Rotation. p. 48, l. 6, add 5 before the Word Parts. p. 49, l. 13, a Cypher inſtead of 2. p. 50, l. 8, read *Depth* inſtead of Length.